

# Certificate

No. V 356 2011 C4

Manufacturer: **Young Tech co, LTD.  
662-8 PungMu Dong, Kimpo City  
KyeongGi Do, 415-809  
Korea**

Product: **Pneumatic volume booster relay**

Type: **Type series YT-3...**

Use /  
Safety function: **Moving into safe position on demand of a safety  
function by internal energy**

Test results: **The devices of the above mentioned series are suitable  
for use in safety related systems in low demand mode of  
operation according to IEC 61508 up to and including  
SIL 3.**

**For detailed results see test report**

**No. V 356 2011 E3 dated 2011-01-13**

**A short summary of test results is filed up on the backside of this  
certificate.**

**The suitability for certain fields of application can only  
be assessed by the evaluation of the complete safety  
related system in regard to the requirements of the IEC  
61508.**

**This certificate remains valid until 08/2015**

**Cologne 2011-01-13**

**Expert**

**Dipl.-Ing. Th. Küppers**

**Test Laboratory  
for energy appliances  
Head of Laboratory**

**Dipl.-Ing. F. Rick**

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type series	YT-3...

#### Appliance-specific values determined:

Probability of dangerous failure on demand	$PFD_{spec}$	Failure/demand	5,03E-06
Test interval	$T_i$	y	1
Confidence niveau	$1-\alpha$	%	90
Safe failure fraction	SFF	%	90,9
Hardware fault tolerance	HFT	[-]	0
Diagnostic coverage	DC	%	0
Type of sub system	IEC 61508-2, 7.4.4.1.2	Type A	
Mode of Operation	IEC 61508-4, 3.5.16	Low Demand Mode	
Assumed demands per year	$f_{np}$	demand/y	10
Interval for closing test		y	1
<b>Derived Values</b>			
Demand/hour	$f_{np}$	demand/h	1,14E-03
Meantime between demands		h	8,76E+02
Dangerous failure rate	$\lambda_D$	1/h	5,74E-09
		FIT	5,74
MTBF dangerous failures	$MTBF_D$	h	1,74E+08
		y	19880,72
Safe failure rate	$\lambda_S$	1/h	5,74E-08
		FIT	57,36
Total failure rate	$\lambda_S + \lambda_D$		6,31E-08
		FIT	63,10
MTBF total		h	1,58E+07
MTBF total		y	1809,15
Dangerous detected	$\lambda_{DD}$	1/h	0,00E+00
Dangerous undetected	$\lambda_{DU}$	1/h	5,74E-09
Safe detected	$\lambda_{SD}$	1/h	0,00E+00
Safe undetected	$\lambda_{SU}$	1/h	5,74E-08
<b>Average probability of failure on demand</b>	<b><math>PFD_{avg}</math></b>	<b>Failure/demand</b>	<b>2,52E-05</b>

#### Test results

In the opinion of the Test Laboratory the booster relays are usable in a low demand mode of operation up to and including SIL 3 in a 1oo1 structure with a hardware fault tolerance of 0  
(See IEC 61508-2, table 2 for type A safety related subsystems)

#### Useful life time under operation conditions

Based on the experience up to now with these devices and regarding the corrosion protection and aging behaviour of the materials used in the FMEA and the type test, a maximum operation time of 5 years is assumed.

In the opinion of the test laboratory a storage under the conditions given by manufacturer of 1,5 years after production and before taking into operation will not have a negative influence.

#### Quality management

These statements are bound to the proven and verified deployment of safety-related quality management of the manufacturer.